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RESEARCH ON POTATO INSECT PROBLEMS—A REVIEW OF RECENT LITERATURE[1]

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This review of the entomological research on potato insects in North America dates from January 1945 to the present (December 1947). However, since it seemed advisable to include all the important papers reporting DDT tests on potatoes, some 1944 articles are listed. The literature for 1947 in press obviously could not be considered here. In addition to studies of fundamental biological and ecological problems, research workers have been continuing their efforts to improve chemical control measures. Undoubtedly the outstanding feature of the period here covered was the rise and general adoption of DDT as an insecticide for use on potatoes. After an amazingly short period of testing, this one material has largely replaced the various insecticides formerly recommended for potato insects throughout North America.

APHIDS—HOST PLANTS AND CONTROL STUDIES

Because of their importance in the transmission of virus diseases, aphids are of considerable concern wherever seed potatoes are grown. In Maine, efforts to solve the aphid problem have involved a study of the relative importance of the host plants in that area (76). This work

[1]Published with the approval of the Director as Paper No. 443, Journal Series, Nebraska Agricultural Experiment Station.

[2]The writer is indebted to Dr. A. A. Granovsky and Dr. G. M. List for reading and constructively criticizing the manuscript.

indicated that year to year differences occur in the relative importance of the alternate hosts and that several years study will be required to evaluate properly the various host plants. One year a certain weed may be more important than another as a breeding host or as a source of infection. A better understanding of the aphid-host plant-virus complex should help explain the variations in amount of virus spread during different seasons and in different localities. The eradication of weed hosts is now advocated as a step toward the control of insect-carried diseases (77 and 85).

The use of insecticides is depended upon in most cases for the control of aphids and the search for a really effective material continues. Although information regarding the effects of chemicals on aphids may be found in several "control" papers to be reviewed later, a few deal primarily with aphids. Bronson *et al* (13 and 14) in Maine found a zinc nicotinyl fluosilicate dust, nicotine sulfate spray, a benzene hexachloride dust and DDT all effective. DDT applied as an aerosol, suspension, emulsion or dust was superior to a derris spray. Treated plots remained green much later in the season than did the untreated. Viruliferous winged aphids were attracted to the green foliage and as a result the sprayed plots were infected with more leaf roll than were the checks. Similar results were obtained in New York by Gyrisko *et al* (34). They reported DDT to be a better insecticide than such standard materials as nicotine, rotenone, and the thiocyanates. The green peach aphid, *Myzus persicae* (Sulz.), was more easily controlled than the potato aphid, *Macrosiphum solanifolii* (Ashm.), probably because of differences in the portion of the plants infested. Potato aphids feed in the rapidly growing terminals, whereas green peach aphids frequent the lower levels and are more apt to come in contact with DDT deposits. Frequent treatments are necessary to keep populations at a low level.

From all appearances in the field, Henderson (35) was able to reduce current-season spread of mosaic in Colorado with a DDT-Lethane spray combination. However, in a recent communication Henderson stated that greenhouse tests with tubers from the field plots gave no evidence of such reduction in spread. Late season spread of the mosaic virus apparently took place as was true in Maine for leaf roll.

Almost complete control of aphids was obtained with DDT in Florida (72). In recent laboratory and field tests hexaethyl tetraphosphate and other esters of phosphorous acids proved superior to nicotine (59 and 74). Considerable field testing of these new chemicals singly and in combinations along with tests of application methods soon may produce truly effective means of controlling aphids. At present DDT seems to be the most promising material to use for this purpose.

Flea Beetles—Taxonomy, Biology and Injury

For a long time it has been known that in certain western areas the principal flea beetle injury to potatoes is caused by the larvae feeding on the tubers, whereas in the eastern states a major portion of the damage results from reduced yields following foliage injury by the adults. After examining a large series of specimens and the published literature Gentner (23) concluded that there are at least three species of black flea beetles found on potatoes that have been considered under the one name, *Epitrix cucumeris* (Harr.). Two of these he described as new. The one in the western United States that commonly causes tuber injury was named *Epitrix tuberis* and designated as the tuber flea beetle. Apparently the tuber flea beetle reaches its eastern, and the potato flea beetle its western limits in Nebraska. The third species, *E. similaris* Gentner, has been found only in California (23).

In Nebraska the type of food plant consumed by caged tuber flea beetles was found to influence markedly oviposition and length of adult life (39). Potato foliage was the most satisfactory food, egg production being highest and mortality lowest on such a diet. The substitution of potato foliage for less nutritious diets was followed in two or three days by increased egg production, and a change from potato foliage to that of other food plants resulted in decreased egg production. In the field, larvae developed most readily and in largest numbers on potato roots and tubers. This study indicated that the elimination of all early plantings of potatoes would lower the general beetle population level by reducing the reproductive capacity and length of life of the overwintered adults. In the absence of potatoes, these beetles would be forced to feed, live and reproduce on less nutritious food plants, thus greatly decreasing the number of first-generation beetles available to infest late-planted potato fields.

The results of a seven-year study of the ecology and control of the tuber flea beetle have been summarized by Hill (41). This work included data on life history, seasonal history, factors influencing flea beetle abundance, such as rainfall, irrigation, host plants and date of planting the potato crop and insecticidal control tests.

Kulash (51) discussed the nature of flea beetle (*E. cucumeris*) damage to potatoes in North Carolina. During recent years he noted tubers from several fields with disfigurations caused by larval feeding severe enough to throw the potatoes out-of-grade.

Wireworms—Feeding Habits and Control

Feeding habits of wireworms, which are at present but little understood, have been studied by Greenwood (29) and Beard (6) in Con-

necticut. In control experiments Greenwood (30) found D-D ineffective under wet season conditions and he considered his results with DDT sprays and dusts inconclusive. More recently Greenwood (31) reported that practical and effective wireworm control could be obtained with from 2 to 2.5 pounds of crude benzene hexachloride (10 per cent gamma isomer) per acre applied in the form of a dilute dust with a grain drill. He also used benzene hexachloride as a seed-piece treatment and as an ingredient in poison baits with less success. Preliminary tests indicated that "benzene hexachloride applied in the row at 1.5 pounds crude material per acre or broadcast at 2.5 pounds crude material per acre does not contaminate the tubers."

Pepper *et al* (68 and 69) also made known preliminary results of wireworm control experiments with benzene hexachloride and DDT. The results with benzene hexachloride were outstanding. Fall applications of 1.6 pounds of the gamma isomer per acre and spring applications of 2.0 pounds of the gamma isomer per acre gave good control. A 25-pound application of technical grade DDT per acre was promising in one test. Sprays and dusts of benzene hexachloride applied to foliage also reduced the amount of wireworm injury to tubers. Although some off-flavor was detected in potatoes from plots treated with benzene hexachloride most tasters could not detect any impairment in flavor in these tests.

Potato Psyllid—Ecology and Disease Relationship

The results of a five-year study of the potato psyllid, *Paratrioza cockerelli* (Sulc) is reported in a paper by Wallis (96). This work was done in Nebraska and Wyoming and indicates that the insect does not overwinter in this area and that infestations originate from some outside source each year. Data concerning host plants and the relationship of temperature to the seasonal abundance of this important potato insect are also presented.

In a paper based on an examination of the weather records covering a 26-year period (1921-1946) Hill (40) correlated the very severe psyllid outbreak in Nebraska with an unusual weather sequence occurring that year. The summer was peculiar in that an extraordinarily wet July with very few hot days was followed by two months of exceptionally warm weather. Infrequent occurrence of hot July days permits psyllids to become established on the small plants in late-planted potato fields at a time when the foliage offers little protection from the heat. Later, when vine growth is dense enough to shade the lower portions of the plants and the soil surface, relatively high temperatures become essential for maintenance of optimum developmental conditions.

Under certain conditions a type of internal necrosis was found to occur as a tuber symptom of psyllid yellows (82). The same investigators, Snyder *et al* (83) also reported that typicall spindling or hair sprout was induced by infesting plants approaching maturity with the potato psyllid. There was no evidence that a virus was involved and the condition was not transmitted through the tubers. It appeared that a toxin produced by the psyllid was responsible.

Six-Spotted Leafhopper—Disease Relationship

In experiments reported by Jensen and Tate (47), two out of 56 greenhouse-cultured potato plants exposed to viruliferous six-spotted leafhoppers, *Macrosteles divisus* (Uhl.), developed symptoms of aster yellows. The symptoms appeared 35 to 40 days after inoculation. Field-grown plants exposed to viruliferous leafhoppers failed to develop symptoms. Although viruliferous leafhoppers were found in western Nebraska potato fields, the time interval between the appearance of the insects in significant numbers and maturity of the potato plants is generally less than that required for development of the aster yellows symptoms. Bonde and Schultz (8) report the transmission of another virus disease by the six-spotted leafhopper which is thought to be different from purple-top wilt but resembling apical leaf roll.

A tuber condition known as net necrosis is common in certain potato-producing areas. This tuber condition has been associated with psyllid yellows. However, in experiments conducted by List (56) in Colorado, no evidence was obtained to show that psyllids cause net necrosis. Nevertheless, strong evidence was presented suggesting that net necrosis is an effect of aster yellows. Protection of plants from attack by six-spotted leafhoppers prevented both aster yellows in asters and net necrosis in potatoes.

Varietal Responses of Potatoes to Insects, Their Transmitted Diseases and Insecticides

The search for potato varieties resistant to insects continues and indications of progress have appeared in the literature. Recently the variety Sequoia was described (22) as having marked resistance to damage caused by flea beetles and potato leafhoppers. Likewise, moderate resistance to flea beetle, leafhopper and the tipburn complex has been claimed for the Potomac (46). Stevenson (86) recently summarized reports from various sections of the country regarding resistance and susceptibility of certain varieties to insects. In addition to the Sequoia and Potomac the variety Menominee was reported to be resistant to hopperburn in Ohio (86).

In experiments by Larson (54) in Wisconsin, Russet Burbank, Warba and Sebago varieties showed a high degree of resistance to yellow dwarf. The clover leafhopper vector, *Aceratagallia sanguinolenta* (Prov.), was as prevalent on resistant as on susceptible varieties. Folsom and Stevenson (20) obtained seedlings resistant to the natural spread of leaf roll and, in their paper, discuss and review pertinent literature regarding some of the factors affecting the spread of viruses by aphids. According to Bonde and Simpson (9) the varieties Teton, Pawnee, and Houma, possess resistance to leaf roll infection. In a study by Adams (1) the suggestion is made that "resistance to aphids in potato varieties may ultimately provide a means for the effective control of aphid-borne viruses in the field." This detailed study showed that potato varieties differ greatly in their reactions to the feeding of the green peach aphid.

One of the interesting recent trends in potato research involves the testing and evaluating of potato varieties in conjunction with the use of insecticides and fungicides. The yield of 13 varieties studied in Ohio by Sleesman and Bushnell (78) was increased after spraying with Bordeaux mixture. Bliss Triumph, a variety highly susceptible to leafhopper injury, gave the greatest increase, whereas the resistant Sequoia gave the smallest increase in yield. This work was continued with a combination spray of DDT and copper oxychloride sulfate, the results being recorded by Wilson and Sleesman (106). Responses to spraying were closely correlated with varietal susceptibility to potato leafhoppers. The three varieties with the highest leafhopper populations (Warba, Bliss Triumph and Pontiac) showed the greatest percentage increase in yield from spraying. Yield increases from spraying Sequoia, Russet Rural and Erie, varieties having lowest leafhopper populations, were lower.

Growth Responses of Potatoes to Insecticides and Insect Populations

Marked growth responses of potato plants treated with DDT have been observed by many individuals. Statements regarding this may be found in several of the general "control" papers (16, 33, 37, 38 and 80) and a few articles have appeared that deal specifically with this subject. According to Walp (98) plants sprayed with DDT had more leaves and the leaves were more flexible and contained a greater amount of chlorophyll. Wilson and Sleesman (105) studied the effects of spray materials on blooming. Bordeaux mixture caused the greatest decrease and DDT the greatest increase in amount of bloom. Various combinations of copper fungicides, organic fungicides, calcium arsenate and

DDT were also tested. In general, the copper fungicides depressed bloom whereas some of the organic fungicides caused slight increases. Combinations of DDT and organic fungicides increased bloom, Zerlate plus DDT practically doubling it. Where DDT was used alone, bloom was most persistent and increased as the amount of material applied per acre increased. DDT encouraged heavy vegetative growth. Plummer and Carter (70) were unable to demonstrate that DDT is translocated from the foliage to the tubers. Rumors of "plant stimulation" have been made frequently but to date no experimental data supporting such reports have been published.

The potato leafhopper, *Empoasca fabae* (Harr.), has long been recognized as a pest of potatoes but only now are we beginning to appreciate the full importance of its injuries. This is especially true, as is indicated in an article by Wolfenbarger and Heuberger (107), when the population is light. They point out that under such conditions more conspicuous pests and ailments often mask the damage being inflicted by the leafhoppers. These investigators noted that "Leafhopper densities and yields are significantly related, with increasingly greater yields from lower than from higher densities." The reduction of heavy populations increases yields, but the "elimination of the total population is much more effective in increasing yield than the control of, for example, 85 per cent of a dense population." Thus "one leafhopper in a light infestation is much more injurious than one in a heavy infestation."

It may be that a lack of appreciation for the damage caused by small populations of heafhoppers or other insects is responsible for the belief held by many that potato plants are stimulated by DDT. In the absence of proof of plant stimulation, it seems entirely logical to assume that the growth responses made by potato plants treated with DDT is due to the fairly complete removal of insect pests which have in the past inhibited normal plant development. This view is held by many entomologists and was expressed by Rawlins (71) when he stated "research men have found in DDT no magic that will influence good growth of potatoes unless insects are present in injurious numbers."

Field Techniques—New Aspects and Methods of Evaluating Results

The highly toxic and residual nature of DDT and other new insecticides is now requiring the utmost care on the part of investigators in order that they avoid making mistakes in their comparative tests. The importance of this is illustrated by Wilson and Sleesman (104) who found that the drift of small amounts of DDT from plot to plot

during application and the persistence of this material in the spray equipment were sufficient to affect materially experimental results. The drift problem is even more important when the insecticides are applied in the dust form. That reliable data may be obtained from experiments, entomologists must now give more thought and care to planning and conducting their field experiments than was generally believed necessary in the past.

Apple and Arnold (2) demonstrated that the specific gravity of potato tubers which has been used to evaluate varieties in fertilizer and cultural practice studies could also be employed as a means of determining the effectiveness of insecticides in the control of leafhoppers. They found that tubers having the highest specific gravity, *i.e.* the best eating quality, were from plots having the lowest nymphal populations and highest yields. The calculated pounds of starch produced per acre "was shown to be a better criterion of the effectiveness of the insecticides than the yields. . . ."

A paper meriting the attention of research workers is that of Sun and Shepard (88) which deals with methods of calculating and correcting the mortality of insects in both laboratory and field experiments. These investigators point out that misleading results are obtained with the usual methods of counting mortality especially for insects having rapid rates of reproduction such as aphids. An equation is presented which tends to eliminate this source of error.

Miscellaneous Insect Species and Problems

Landis and Getzendaner (53) have observed moderate to heavy populations of white flies, *Aleyrodes spiraeoides* Quaint., on potatoes in the Yakima Valley, Washington. In this same area the two-spotted spider mite, *Tetranychus bimaculatus* Harvey, has recently caused potato plants to die prematurely (52). This damage either seemed to be associated coincidentally with or caused by the use of DDT. The greatest amount of injury occurred in fields which had received four or five applications of DDT.

In Maine, Bean (5) records the presence of larvae of a syrphid fly, *Eumerus strigatus* Fallen, in decayed and diseased potatoes and shows the possible relationship of this insect to some potato rots and diseases.

The potato tuber moth, *Gnorimoschema operculella* (Zell.), was the subject of two articles. Boyd (11), working in New Jersey, came to the conclusion that this insect could overwinter only in the pupal stage. In California, Mackie (60) discussed the tuber moth problem with special reference to its quarantine aspects.

A five-year comparison of the relative abundance of potato flea beetles, leafhoppers and Colorado potato beetles, *Leptinotarsa decemlineata* (Say), has been published for North Dakota (63). This survey showed that leafhopper populations fluctuated most widely. According to a resumé of the Colorado potato beetle infestations in British Columbia (99), the work done by the Department of Agriculture in controlling that insect at a cost of less than $5,000 yearly is now resulting in an estimated annual saving of more than $100,000 to farmers in that Province.

In a paper that may anticipate a future problem in other areas Holcombe (43) traces the decrease in number of bee colonies in New Jersey to the dusting program used by farmers in controlling potato insects. The increased use of the airplane for the distribution of modern insecticides may multiply such reports in the next few years.

Werner (102) included a chapter on potato insects in his recent comprehensive bulletin on commercial potato production in Nebraska. He discussed briefly the insects involved, their injuries and the cultural and chemical control measures that have proven effective.

Early Investigations with DDT

Among the earliest reports regarding the effectiveness of DDT on potato insects in this country were the laboratory and greenhouse tests of Swingle and Mayer (89) and Weigel (100) and the small field plot tests of Howard (45). The more extensive field tests reported by Granovsky (25 and 26) further indicated that DDT was destined to become an important and useful insecticidal material for the control of potato insects. Although Granovsky's emphasis was on the control of potato flea beetles, potato leafhoppers and the tarnished plant bugs, *Lygus oblineatus* (Say), he observed that DDT reduced populations of other insects, such as the Colorado potato beetle, the six-spotted leafhopper, the alfalfa plant bug, *Adelphocoris lineolatus* (Goeze), and the rapid plant bug, *A. rapidus* (Say). The above research with DDT was done in 1943.

Chemical Control Literature Appearing in 1945

In 1944 DDT was tested widely on potato insects throughout the entire United States and Canada and late that year and during 1945 the results appeared in several papers. Some of these reports were preliminary in nature (19, 37, 42, 48, 73, 75, 90 and 97). A summary of the results obtained with DDT by the Division of Truck Crop and Garden Insect Investigations during the 1944 season was issued as a processed paper (103). Preliminary data from eighteen different state

agencies were collected by the Bureau of Entomology and Plant Quarantine and issued in a like manner (3). Almost without exception, these widely scattered experiments showed DDT to be superior to any other insecticide known for the control of most of the major insect pests of the potato.

In more detailed papers the story was similar. In Connecticut (93), "DDT dust at 0.5 per cent was more toxic to potato flea beetles than 50 per cent cryolite. On the same pest, 0.5 per cent DDT was as effective as 2 per cent rotenone." For European corn borer on potatoes 1 per cent DDT was as effective as 2 per cent rotenone, whereas DDT was outstandingly more effective than Bordeaux mixture against leafhoppers. In New York (33), DDT "produced very favorable reductions in infestations of Colorado potato beetles, aphids, flea beetles and leafhoppers." Sprays containing DDT gave "prolonged residual effectiveness." In Ohio (79 and 80) DDT "gave the most outstanding performance of any material that has been recorded for use on potatoes during the past twenty-five years. This insecticide used alone and in combination with various fungicides, gave remarkable control of the potato leafhopper, exceptional flea beetle control, and significantly higher yields (at the one per cent level) than those secured with any other treatment." In Iowa (16), a 3 per cent DDT dust "gave the best protection and the highest yield, nearly 70 per cent increase over the control." In Nebraska (38), field tests showed DDT to be more effective than any material yet tested against the principal potato insects, including tuber flea beetles, potato psyllids, potato leafhoppers and aphids. Also, it was more promising than anything yet tried for reducing populations of Uhler's leafhoppers, *Aceratagallia uhleri* (Van D.), ragweed plant bugs, *Chlamydatus associatus* (Uhl.), and pale legume bugs, *Lygus elisus* Van D., which often are abundant in Nebraska potato fields. Certain beneficial species also were reduced, but it was believed this would not prove detrimental under Nebraska conditions. In North Dakota (65), a 5 per cent DDT dust gave best yields in cooperative tests, whereas in Colorado (55) under conditions of a rather heavy psyllid infestation, higher yields were obtained with DDT dusts and sprays than with the then recommended liquid-lime sulfur sprays or sulfur-cryolite dust mixtures.

Granovsky (27) used various concentrations of DDT in combination with yellow cuprocide or tribasic copper sulfate. Combinations of DDT with 5 per cent yellow cuprocide "gave much better control of most of the potato insects than the same concentrations of DDT alone." The combination of DDT and pyrethrum also was found

promising. In this same article and in another (28) Granovsky pointed out that although DDT showed considerable residual value under field conditions, killing many common pests for two weeks or more, the lasting qualities were not so great on foliage as when the material was used indoors.

Goodhue *et al* (24) and Smith *et al* (81) tested the aerosol method of application of insecticides on potatoes in Maine. DDT aerosols proved effective against aphids, potato flea beetles, Colorado potato beetles, potato leafhoppers, tarnished plant bugs and six-spotted leafhoppers. Aerosols containing DDT were more effective than those containing derris or nicotine. Against potato aphids this method was very promising. The nature of aerosols is such that maximum contact is obtained and this method seems to produce better results under conditions of dense foliage than the conventional sprays or dusts. However, before aerosols can be adopted to field use, equipment to handle and apply the materials must be perfected. That doubtless will require considerable additional research.

Not all the papers appearing in 1945 dealt with tests of DDT. Wene and Rawlins (101) studied the compatibility of cryolite and certain copper fungicides. Bordeaux mixture delayed the toxic action of cryolite to the Colorado potato beetle, but apparently did not reduce the final kill. In Connecticut, Turner (92), experimenting with dust diluents having different pH values, found that "cryolite-talc (pH 9.1) dust was substantially less effective thna cryolite-pyrophyllite (pH 7.0) dust in controlling potato flea beetles. At best 50 per cent cryolite-talc was not as toxic as 12.5 per cent cryolite-pyrophyllite."

According to Campbell (17) in New Jersey certain neutral copper compounds did not equal Bordeaux mixtures as a repellent for flea beetles but neither was their use followed by reductions in yields, as so often happens when potatoes are sprayed with Bordeaux. Dithane gave relatively poor protection against flea beetles.

In preliminary tests reported by Turner (94) potato plants absorbed disodium ethylene bis dithiocarbamate (Dithane) from the soil in amounts sufficient to affect insects infesting the plants. When watered on the soil, European corn borer damage was reduced and substantial control of potato leafhoppers and tipburn was noted. There was some indication that Dithane was injuring the plants, but the four Dithane treatments outyielded the four Bordeaux treatments. This work arouses interest, for as stated by Turner, "The fact that an organic compound acted in this manner offers a very interesting new field for exploration." In this connection Pepper *et al* (69) more recently (1947)

observed less leafhopper injury to potato plants growing in soil treated experimentally with benzene hexachloride for the control of wireworms. The plants in treated plots remained green much longer than did those in untreated check plots, which led the investigators to believe "that some substance toxic to the potato leafhopper was taken up by the plants from the benzene hexachloride plots."

Chemical Control Literature Appearing in 1946

An inspection of the "control" articles published in 1946 revealed that most investigators emphasized tests of DDT and fungicide combinations during their 1945 experiments. A summary of results with DDT in Connecticut, Nebraska, New Jersey, New York, Ohio and Pennsylvania was assembled and published in the *American Potato Journal* (4). Some of the findings follow:

In Connecticut, DDT provided superior control of leafhoppers and tipburn and gave yields as high as those secured with Bordeaux mixture. Where flea beetles were abundant, DDT alone produced a higher yield than did Bordeaux mixture alone. In a Nebraska experiment, a dust containing 3 per cent DDT in pyrophyllite and one containing 1 per cent DDT fused with sulfur gave similar degrees of control of tuber flea beetles in plots 24 hours following application. However, the DDT-sulfur dust remained more effective over a period of several days and continued to kill many newly developed beetles as they emerged from the soil. In another test, soil treatments with DDT significantly reduced the amount of flea beetle larval damage to the tubers. The data indicate that this method of fighting tuber flea beetles might, with some refinements of formulations and means of application, be of value under certain conditions. In 1945, for the first time in Nebraska, airplanes were used for the application of insecticides to potato fields. DDT dusts applied in this manner and by ground dusters gave excellent kills of tuber flea beetles. However, ground machinery appeared more effective than airplanes against leafhoppers and mirids. In New Jersey under conditions of a low insect infestation, DDT plus Bordeaux or tribasic copper (Microgel) applied to Katahdin potatoes resulted in yield increases of 86 and 34 bushels per acre, respectively. A 3 per cent DDT-copper-lime dust was ineffective and gave no yield increase, whereas a 3 per cent DDT-tribasic copper-talc dust reduced the leafhopper population slightly and increased yields 38 bushels per acre. In New York where DDT proved very satisfactory in comparison with other insecticides for aphid control, it was found that the amount needed to keep aphids adequately in check was higher than for other potato insects. By increasing the amount of DDT up to 2.25 pounds

per acre progressively increased yields and better aphid control resulted. When emulsions were used comparable results were obtained with one-fourth the amount of DDT necessary when used in wettable powder form. In Ohio DDT in combination with various fungicides produced an average yield increase of 51 per cent (141 bushels per acre) over that obtained with combinations of calcium arsenate and the same fungicides. DDT "completely eliminated the potato leafhopper as a factor in reducing yields," gave better control of flea beetles than did calcium arsenate and when "applied at 10-day intervals throughout the growing season, gave good control of aphids." In field demonstrations in Pennsylvania DDT was shown to increase yields in proportion to the number of applications made during the season.

Bonde and Snyder (10) reported yield increases varying from 16 to 32 per cent when DDT was used with different fungicides. Since certain shortcomings of the neutral copper and organic fungicides appeared to be offset when used with DDT, these investigators stated that such combinations may replace Bordeaux mixture. Their work further showed that "the protective value of some spray fungicides for the control of early and late blight has increased when used in combination with DDT. Also the protective value of DDT for the control of flea beetles likewise was increased by being combined with a fungicide." Heuberger and Stearns (36), in summarizing their compatibility study, state "DDT gave excellent leafhopper control and high yield responses; DDT has no fungicidal value; DDT is non-injurious to potatoes when used alone or in combination with the fungicides tested; DDT and several inorganic and organic fungicides are compatible since each material was as effective when used in combination as when employed alone."

It was evident from a test conducted by Thurston (91) in Pennsylvania "that greater increases in yield may be expected from the combination of DDT with certain organic fungicides such as Dithane, then with Bordeaux mixture, or from a combination of DDT with any fungicide which by itself has poor insecticidal or repellent properties." The Dithane and DDT combination also gave higher yields than Bordeaux mixture and DDT in Ontario tests, according to Berkeley *et al* (7). When added to copper-lime dust DDT was ineffective in controlling leafhoppers, and Lethane B-72 was inferior to DDT as a control for this insect. In another Canadian paper (21) results with DDT were similar but differences caused by fungicides were not considered significant.

List and Edmundson (57) also found DDT to be compatible with Bordeaux and Dithane. Sprays containing basic copper arsenate, DDT alone or with Bordeaux mixture or Dithane gave highly significant and

equal control of tuber flea beetles. Based on the amount of tuber injury 3 per cent DDT dusts, at the rate of 25 pounds per acre, failed to control the tuber flea beetle. However, figures given for the adult population show significant control suggesting that the lack of control of larval injury may have been caused by improper timing of the applications. *Lygus* populations were reduced by both lime-sulfur sprays and DDT, whereas all DDT treatments significantly reduced the numbers of leafhoppers.

A total of 16 spray and 17 dust combinations were tested by Munro and Hoyman in North Dakota (64). Treatments with DDT gave highest insect kills; dichloro diphenyl dichlorothane (DDD) and arsenicals ranked lower in that order. The six-spotted leafhopper showed highest resistance to the treatments, whereas potato leafhoppers, potato flea beetles and Colorado potato beetles showed lower resistance in that order. The most effective combination spray contained zinc-dimethyl-dithio-carbamate (Zerlate) and DDT. Zerlate and DDT also were included in the most effective dusts. Copper A-DDT and Copper A-Zerlate-DDT dust combinations were also good.

Brandes and Swisher (12), also working in North Dakota, tested spray and dust treatments in large field demonstrations. DDT sprays and dusts again gave higher degrees of insect control. Little or no differences in yields were obtained with Dithane-DDT, ferric-dimethyl dithiocarbamate (Fermate)-DDT, Copper A-DDT, Dithane-arsenicals and Cuprocide-DDT sprays. However, Dithane-DDT outyielded the general group of copper-arsenicals by 22.2 to 62.3 bushels per acre. Yield differences in dust plots were only slightly significant but "the copper-DDT plots outyielded copper arsenical plots 8.3 to 44.3 bushels per acre."

In field trials on Long Island, Gyrisko (32) found a mixture of DDT isomers, DDD and DDT equally effective in their toxicity to and residual action on flea beetles and leafhoppers. A new insecticide dust containing piperonyl cyclohexanone added to pyrethrum marc (PCH) and a 3-way dust (containing rotenone, sulfur and pyrethrins) gave good initial kills but did not possess the lasting qualities of DDT and its related compounds. Lethane B-71 was ineffective against flea beetles and was "only fair" for the control of potato leafhoppers.

According to Zappe and Turner (108) one pound of DDT per acre in a xylene-kerosene mixture applied with a helicopter gave promising results for flea beetles and potato leafhoppers. However, the residue from this concentrate was not heavy nor persistent and flea beetles soon repopulated the fields. Campbell and Filmer (18) obtained no out-

standing results with benzene hexachloride in preliminary tests in Pennsylvania but considered the material worthy of further study.

Chemical Control Literature Appearing in 1947

In 1947 papers appeared reporting results with several newer insecticides. By then DDT was generally "accepted" and often used as a standard for evaluating the new chemicals. Brooks and Anderson (15), working in Virginia, found a DDT spray mixture very effective against the potato aphid, and a 0.6 per cent gamma benzene hexachloride dust superior to a 3 per cent DDT dust mixture against this insect species. A calcium arsenate-Bordeaux mixture spray seemed to give best results in reducing the amount of flea beetle damage to the foliage. There was no difference between the various dusts with respect to flea beetle control.

Kido and Allen (49) compared the efficiency of a colloidal DDT with other types of DDT formulations in the field. On potatoes good initial kills of insects were obtained, but the colloidal material seemed to have poor residual qualities as compared with the more conventional emulsions and wettable powders.

Vaughn and Leach (95) tested some exploratory chromate compounds and found that, in addition to their fungicidal properties, they appeared to have some value as insecticides against leafhoppers. Since these observations were made under light leafhopper populations, these men concluded that further experiments under conditions of heavy infestations were needed to evaluate properly the insecticidal properties of the chromate compounds.

According to Horsfall and Turner (44) Dithane alone or with zinc sulfate and lime was almost without effect on leafhoppers or flea beetles in Connecticut. They concluded that in areas where these insects are troublesome, Dithane cannot succeed alone. In a wet season with few insects Dithane outyielded DDT, whereas in a dry season with no disease DDT treated plots outyielded those treated with Dithane. From this the authors further concluded that each of these organic materials "must supplement the other in a complete potato spray."

Stitt (87) working in western Washington found that dusts containing DDT, DDD, DMT (1-trichloro 2, 2-bis (p-methoxyphenyl)-ethane) or benzene hexachloride mixed with C.A.C. (Copper A Compound) were superior to calcium arsenate-monohydrated copper sulfate-lime mixture for the control of flea beetles and aphids. The effectiveness of DDT, as measured by control of aphids and yields, was not affected when used in combination with four different fixed copper fungicides. Stitt also measured the effects of mechanical injury to potato

vines by dusting equipment. Various amounts of wheel damage caused significant to highly significant reductions in yields.

In Michigan Morofsky and Muncie (61 and 62) tested several insecticide-fungicide combinations. In addition to DDT, benzene hexachloride and a chlorinated camphene were used as insecticides. None of the materials tested gave any better control than did DDT alone or in combination with Bordeaux or the fixed coppers. In dusting experiments the combining of DDT with monohydrated copper sulfate-lime was not followed by reduced yields. Thus the lime did not lessen the effectiveness of DDT in that instance. However, yields were apparently reduced by the addition of benzene hexachloride to Bordeaux mixture or to the zinc and copper salts of nitrodithioacetate.

List and Payne (58) reported promising results with 1-trichloro-2, 2-bis-(p-bromophenyl)-ethane referred to as Colorado 9. This chemical is closely related to DDT and when used in the field on potatoes showed promise of controlling psyllids, tuber flea beetles and leafhoppers.

Roark (74) in his digest of information on hexaethyl tetraphosphate listed some results from an unpublished report by Chapman, Voss and Allen of the Wisconsin Agricultural Experiment Station. These investigators obtained a 90 per cent kill of potato aphids with hexaethyl tetraphosphate (1 pt. (50 per cent) per 100 gallons of spray) as compared with a 25 per cent kill with nicotine sulfate (1.6 pt. (40 per cent) per 100 gallons). This new chemical also showed considerable toxicity against potato leafhoppers and the six-spotted leafhopper. Against the latter species a 1:800 spray was more effective than 2 pounds of DDT per 100 gallons of water. Against potato flea beetles hexaethyl tetraphosphate was inferior to DDT.

Stearns *et al* (84) and Parker and Beacher (67) tested in a preliminary way chlorinated camphene (Toxaphene) against potato leafhoppers and concluded that further experiments would be required before its status could be determined. The material produced a severe chlorosis of the foliage to Dakota Red and Irish Cobbler potato varieties when sprayed with a suspension of 1 pound of 50 per cent powder in 100 gallons of water.

O'Kane (66) reported that benzene hexachloride controlled Colorado potato beetles and potato flea beetles and that good kills of aphids were obtained, but for potato leafhoppers this material was not satisfactory. He also emphasized that crude benzene hexachloride caused objectionable odors in some food products and that potatoes were susceptible. He further stated, "Either soil conditions, or variety, or both, may have

an influence. Although no off-flavor was in evidence in some tests, an unpleasant flavor was present in others."

Kulash (50) tested some of the newer DDT formulations and other organic insecticides for the control of Colorado potato beetles in North Carolina. DDT formulations with the exception of one containing a high ortho-para isomer content gave good control. Chlordane was good but not superior to DDT; a piperonyl cyclohexanone-pyrethrum concentrate was poor and although benzene hexachloride was good, it had no great residual qualities. No phytotoxic effects were noted and no taste or odor was found in tubers cooked or raw one month after treatment with any of the materials used. DDT and benzene hexachloride were equally effective in killing potato flea beetles in other tests reported by Kulash (51). However, a 3 per cent DDT dust seemed to outlast any of the tested water miscible DDT spray concentrates or benzene hexachloride spray.

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   E-644g Texas Agr. Exp. Sta.
   E-644h No. Dak. Agr. Exp. Sta.
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EFFECT OF SPRAYER-WHEEL INJURY ON THE YIELD OF POTATOES

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It has been known for some time that the injury to potato plants caused by the sprayer has some effect on yield. The extent of this effect and any differential among varieties as to their susceptibility are not well established.

An opportunity to study these factors was afforded by a replicated and randomized variety yield test at Richford, New York, in 1947. This test included 26 varieties in four replications arranged according to season of maturity in randomized blocks. The test was planted on the 28th of May and was completely killed by frost on the 22nd of September before any but four of the varieties were naturally matured. The plot was sprayed frequently throughout the season with a power sprayer equipped with a 10-row boom and hauled by a four-wheel tractor, the sprayer and tractor straddling two rows. No vine lifters were used. The same wheel-rows were used throughout the season, injury being confined to one side of any given row. Since the planting plan did not provide for randomizing to equalize or neutralize sprayer-wheel injury, in plotting the injured rows it was found that two of the 26 varieties were not contacted at all, whereas the remaining 24 varieties were next to the sprayer and tractor wheels in one, two or three of the four replications. This made it possible to compare yields of the injured with the uninjured replications of each of 24 varieties. In no case was the stand of plants less than 96 per cent and in only five of the 26 varieties was it less than 100 per cent. Therefore stand need not be considered when significance of yield differences is applied.

A comparison of yields of No. 1 sized tubers on injured and uninjured plots of each of 24 varieties of potatoes is given in table 1.

DISCUSSION

The weighted average yield of all varieties affected by sprayer-wheel injury was reduced by 108.0 bushels to the acre or by 22.0 per cent. There were three varieties, namely, Snowdrift, Sir Walter Raleigh, and Pontiac, which actually averaged a higher yield in the injured than in the uninjured replications. For this there is no obvious explanation since the stand of each was 100 per cent. The significance of the

[1]Published as Paper No. 297. Department of Vegetable Crops, Cornell University, Ithaca, N. Y.

TABLE 1.—*Effect of sprayer-wheel injury on yield of potatoes*

Variety	Yield of No. 1 Size Tubers in Pounds per Plot					
	Not Injured		Injured		Difference	
	No. of Plots	Yield	No. of Plots	Yield	Yield	Per Cent
Warba	3	52.2	1	34.0	18.2	34.9
Red Warba	1	48.0	3	35.0	13.0	27.1
Cobbler	2	48.8	2	32.8	16.0	32.8
Chippewa	1	52.0	3	39.2	12.8	24.6
Chenango	1	38.0	3	28.3	9.7	25.5
Genesee (y)	4	42.6	0	——	——	——
Essex	3	57.8	1	44.5	13.3	23.0
Houma	3	35.0	1	31.0	4.0	11.4
Ashworth	1	63.5	3	48.2	15.3	24.1
Snowdrift	2	33.8	2	41.5	7.7(x)	22.8(x)
Green Mountain	3	53.5	1	43.0	10.5	19.6
Mohawk	2	55.5	2	38.5	17.0	30.6
Placid	2	63.3	2	41.8	24.5	38.7
Virgil	2	52.8	2	47.5	5.3	10.0
Katahdin	3	45.5	1	19.0	26.5	58.2
B70-5	1	71.5	3	48.3	23.2	32.4
Sir Walter Raleigh	3	35.7	1	45.5	9.8(x)	27.5(x)
Russet Rural (y)	4	36.3	0	——	——	——
Pontiac	3	38.8	1	45.0	6.2(x)	16.0(x)
Sebago	2	58.0	2	51.8	6.2	10.7
Teton	3	58.7	1	39.5	19.2	32.7
Erie	3	49.5	1	25.5	24.0	48.5
Ontario	2	56.5	2	44.3	12.2	21.6
Empire	2	61.5	2	44.5	17.0	27.6
Fillmore	2	45.8	2	32.0	13.8	30.1
Sequoia	2	67.0	2	34.3	32.7	48.8
Totals	52	1242.7	44	935.0		
Ave. (Unweighted)		51.78		39.0	12.78	24.7
Ave. (Weighted)		50.75		39.6	11.15	22.0
Ave. bushels per acre		491.3		383.3	108.0	22.0

(x) Difference in favor of sprayer-wheel injury.
(y) Not included in totals.

22 per cent reduction in yield of the affected plots has not been determined statistically. Whether the odds are high enough to be considered significant even at the 5 per cent level can perhaps be judged from the fact that of a total of 96 plots eligible for comparison there were 11 instances in which any one of the one or more injured replications of a given variety outyielded the corresponding uninjured plot or plots. On the basis of paired comparisons, this is a ratio of about 8 to 1 in favor of the uninjured replications.

It may be noted from the data in table 1 that the reduction in yield from wheel injury among the 21 varieties showing a reduction ranged from 10.0 per cent for Virgil, a rank growing, blight-resistant variety, to 58.2 per cent for Katahdin, a variety of perhaps only average plant size. The percentage reduction yield from wheel injury was actually higher for such early, small, upright growing varieties as Warba and Cobbler than the average for all adversely affected varieties which was 29.2 per cent. Therefore, any differential response of varieties to wheel injury does not appear obvious in this instance. These observations are incidental to the interpretation of yield results from a replicated potato variety test not designed to study the subject of sprayer-wheel injury. However, they appear to be of enough significance to draw attention to the importance of this factor in the design and interpretation of results from yield trials.

Conclusions

A comparison of yields from sprayer-wheel injured and uninjured replicates of 24 varieties of potatoes grown in 1947 in Tioga County, New York, seem to justify the following conclusions:

1. Under favorable conditions of high elevation, high soil fertility level, and ample rainfall for potato plant growth, yield may be reduced from 10 to more than 50 per cent by vine injury caused by sprayer and tractor wheels.

2. In any well planned variety test a few instances of no yield reduction from wheel injury may occur. These must be explained on the basis of experimental error, soil variability or some other influential factor not always obvious.

3. The extent of wheel injury to the growing potato plant does not appear to bear any significant relation to season of maturity or habit of growth of the variety.

4. Potato experiments and particularly potato variety yield tests should be so designed that the factor of sprayer-wheel injury can be either neutralized or taken into account in the interpretation of results.

PRESENT STATUS OF THE GOLDEN NEMATODE OF POTATO

W. A. McCubbin

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture, Washington, D.C.

The present status of the golden nematode can be best understood by discussion under three heads: *Survey,* to locate areas where the pest is present; *control,* to suppress it in field or crop; and *quarantine,* to prevent spread.

Survey.—The golden nematode is essentially an external root parasite of the potato and tomato, living over in soil for eight or more years, and retarding potato plant growth and tuber size by feeding on the root system in immense numbers. It was probably brought here from Europe, where it has been known for years as an important potato pest. It was first recognized in 1941 in fields near Hicksville, Long Island, though it had probably been present there several years previously.

Surveys in Long Island have enlarged the known infested acreage from the few original centers first observed to nearly 6000 acres at the end of December, 1947, all but 30 acres of which are in Nassau County. Except for this one field, it has not been found in extensive surveys in Suffolk County, and none has been found in a general survey in the northeastern states in 1944, or in survey in 1947 in Steuben County, New York, and in 3000 acres examined in Maine.

The Long Island infestation still represents the only known occurrence of this pest on the continent to date.

Because light infestations of the parasite produce no distinctive symptoms on tops or tubers, it is necessary to look for the nematode itself, either by the examination of potato roots in the season of vigorous growth, or by a soil sample method by which the nematode cysts (mature egg sacs) are separated out by washing and screening from numerous ounce lots of soil taken in grid pattern over a field. By neither method can slight infestations be detected with certainty. Consequently, nematodes may be present in low concentrations for several crop years before they can be detected successfully, and thus have much opportunity to spread elsewhere before they are found.

Summary of report presented to the New Jersey Potato Growers' Association, Trenton, New Jersey. January 29, 1948.

Control.—Several soil fumigants, including D-D, have given a high rate of kill, but none of these under field conditions has approached complete destruction. Hence soil treatment could only be expected to reduce nematode damage temporarily; starvation is the only reliable means yet known to accomplish eradication.

Methyl bromide will kill the nematode in potato lots and adherent earth, but at effective dosage rates tuber injury is encountered.

Various chemical baths have been tried on tuber lots. The most promising has been ammonia in heated solution. It is not yet commercially practicable, however, and needs further investigation.

Washing and brushing methods will remove a considerable percentage of the nematodes from tubers, but those still left on the tubers constitute a danger of spread that cannot be ignored.

Quarantine.—Measures which aim to prevent the spread of the golden nematode must take into consideration numerous carriers. Predominant are potato shipments, together with their adherent earth and debris and soil in sacks, containers, trucks, and railroad cars. Other root crops which bear away adherent soil are likewise dangerous. All nursery stock and any other type of plant grown in infested soil can carry the pest in adhering earth to a new location. Topsoil movement is especially objectionable. Other effective means of local spread are farm implements and soil carried on automobiles, trucks, tools, containers, or on the feet of man as well as of domestic and wild animals. Flood and surface wash are effective local carriers, as is also wind.

Quarantine effort must control all these means of spread to keep the golden nematode bottled up within its present area. In a heavily populated area, such as Long Island, where there is intense and varied activity, it is a herculean task to stop outward spread, and if heavy nematode populations are allowed to build up in the infested lands by continued potato production, any permanent prevention of spread is practically out of the question.

The quarantine measures taken during the last three years in restricting crop movement from known infested fields to relatively safe disposal channels, the withdrawal of approximately 1500 acres from potato production in 1946 and 3500 acres in 1947, and the treatment of some 1500 acres with D-D—have reduced the over-all chance of spread to a low point. When one considers in addition that practically all fields in which the nematode was discovered in 1947 had very light infestation, the danger of spread to date has been extremely small.

However, the golden nematode is not a merely local problem but is one of critical national interest. On the basis of present knowledge,

it would be indefensible to allow a pest of such potential destructiveness to spread to our immense potato areas if it can be held within present bounds. As matters now stand, the most effective action that can be advocated is to suspend promptly and completely potato and tomato culture in all the known infested and exposed land.

Acknowledgments

The writers are indebted to Dr. G. P. McRostie, Head of the Department of Field Husbandry, Ontario Agricultural College, for advice and criticism; and to the Staff of the Dominion Rubber Research Laboratories, Guelph, for supplying 2, 4-D used in these experiments.

NEW POTATO VARIETIES INTRODUCED IN 1947

HAROLD MATTSON[1]

North Dakota Agricultural Experiment Station, Fargo, N. D.

Leaders of potato improvement projects in Canada and the United States have supplied the names of the following potato varieties introduced in 1947:

TWELVE NEW POTATO VARIETIES
INTRODUCED IN 1947

Variety		*Maturity* (Early-Medium-Late)	*Reference*
LaSoda	red	M	Julian C. Miller Louisana State U.
Chisago		E	F. A. Krantz
Setapa	red	M	U. of Minnesota
Waseca	red	E	
Cortland		L	Donald Reddick
Essex		E	Cornell University
Fillmore		M	
Glenmeer	red	L	
Harford		L	
Madison		M	
Snowdrift		E	
Russet Sebago		L	G. H. Rieman U. of Wisconsin

[1]Horticulturist, North Dakota Agricultural Experiment Station.

LaSoda: (Triumph x Katahdin) bright pinkish red skin, one week later than Triumph, medium vigor and upright vine.

Waseca, Chisago, and Satapa are smoother than Cobbler, have ranked with Cobbler in yield and have produced a higher proportion of US-One size tubers than Cobbler and Red Warba in extensive trials for 5 or 6 years in Minnesota.

The seven varieties introduced by Dr. Reddick range from early to very late in maturity. They are only slightly susceptible to late blight. The relatively high resistance of these varieties may be fully adequate for areas where blight is not a serious problem. In blight areas they may relieve the grower of dusting or spraying throughout all but the latter part of the season.

Russet Sebago is a russet mutation of Sebago. It is more resistant to scab and has a tougher skin which makes it better able to stand handling without injury. Russet Sebago has suffered slightly less scab injury than did the Russet Rural in the Wisconsin trials. Scab pustules on Russet Sebago are usually shallow.

Inquiries for certified seed of these new varieties may be directed to Seed Potato certification officials in the various states.

SECTIONAL NOTES

ALABAMA

Our potato crop has passed through one crisis after another. Cold and wet weather at planting time retarded the operation. This was followed by heavy rains in early March and now a general infestation of late blight is reported in some fields. The growers have attempted to overcome the loss of nitrogen resulting from heavy rainfall by making side-dressing applications of fertilizer. Spraying or dusting for the control of late blight is being generally practiced. Despite all our difficulties, prospects seem to be a little better than normal for this time of year.—Frank Garrett.

FLORIDA

Approximately 11,000 acres of potatoes are being grown in the Hastings Section this year. Several thousand acres were replanted during January and February since the seed decayed in soil that was waterlogged by 4.08 inches of rainfall during a 5-day period (Jan. 20-24).

Disaster threatened again in March when rains totaling 8.04 inches fell from the 2nd to 13th. However, prompt application of

fungicides to the crop immediately after the rains ceased and frequent applications thereafter have prevented the occurrence of a disastrous epidemic of late blight.

Digging of the early-planted fields started this week. However, most of the crop is late and harvesting of the entire acreage will probably not be completed until the 1st of June.—A. H. EDDINS.

MAINE

The Blue Tag Certified Seed campaign conducted by the Extension Service is apparently a decided success. The campaign was inaugurated in an effort to get every table stock grower to plant Blue Tag Certified seed. It was felt that such a program would help eliminate ring-rot from local seed. Growers report that sales of certified seed for use in the county are far ahead of any previous year.

Everything points to the fact that Maine farmers are still within their potato allotment program of approximately 186,000 acres.

To date the Government has purchased about 26 per cent of all the potatoes grown in Maine. This does not necessarily mean that Maine has all this surplus. Much of this 26 per cent could rightly be charged against the Northwestern states.

E. L. Newdick, President of the Potato Association of America, is back from Europe and gave an excellent report of his trip to those in attendance at Farm and Home Week on the 8th of April.

Two dates of interest to potato men should be the American Potato Blossom Festival which will be held at Van Buren, Maine, on the 21st of July. The Potato Blossom Queen is selected as part of the festivities. Bill Stempfle of Steuben County, New York, is making preliminary plans for a tour of Aroostook during the week of the 19th of July.

A recent survey by the P. & M. A. showed 14,409 cars of potatoes on hand after the 1st of April.

A new variety "Kennebec" is in great demand but the Maine State Seed Board controls practically all of this variety. It will be grown under their supervision on a farm which was purchased this year for the purpose of multiplying the best seed stocks in the state.—VERNE C. BEVERLY.

NEBRASKA

As of the first of April, practically all potatoes in Nebraska had been sold or were contracted for sale, and the processing plants were completing their operations for the year. Some of them have already shut down for the season. A very few shipments of certified seed po-

tatoes, principally of the Red Warba variety, remain undelivered. These are moving out rapidly to the central and eastern parts of Nebraska, where planting usually gets under way right after the first of April. Because of somewhat unsettled weather conditions, very little planting has taken place yet, although it is considered that this area can plant safely up through the first half of April.

Planting intentions for the late main crop in the western part of the state are not very well established at this time. Considering the sales of local seed, both certified and commercial, it is apparent that the acreage will be about the same as last year, which was below 1946. In view of the fact that good prices were paid for the commercial crop during the past winter, it seems that the acreage should be somewhat increased. A summary of prices paid growers reveals that the average price for U. S. No. 1 grade washed potatoes was between $3.40 and $3.50 per cwt. f.o.b. cars. This excellent price is considered as an incentive for the maintenance of the usual acreage, and possibly for some increase of acreage this coming year.

The competition of other crops with potatoes that have been high yielding, and high priced, is very strong. Principal among these crops are wheat, sugar beets, and dry white beans. Farmers, in general, in this area have enjoyed a very successful season.—MARX KOEHNKE.

NEW JERSEY

Potato planting in New Jersey has been slightly delayed by cold wet weather but it is expected that all of the anticipated acreage, estimated a t58,000, will be planted by the 1st of May.

Considerable frost injury and stem-end discoloration have been found in seed received from the northern states but otherwise the seed has been satisfactory. The majority of the stem-end discoloration is believed to be caused by the use of vine killers. According to present information this type of browning will not injure the prospective yield.

Growers are using considerably more fertilizer than is recommended by the Experiment Station. With potatoes selling at relatively high prices it takes a very small yield increase to pay for the extra fertilizer used. However we have every good reason to believe that much of the excess fertilizer is wasted and if such should be the case during a dry year a reduction in yield would automatically result.

The neutral coppers have practically replaced monohydrated-copper in dusts used for blight control and they are also being widely used in the place of copper sulfate in potato sprays.—JOHN C. CAMPBELL.

NEW YORK

The table stock deal in New York State is about over. There are a few odd lots but most growers are through and working on the land. Our markets for the past two weeks have been dull.

Certified seed business is good. Growers were late in getting allotments and making plans but with the advent of spring weather the seed potato business came along like spring flowers.

In general, the growers are much distressed by the possible provisions of the Support Program. They do not like to have their responsibility go any further with potatoes sold to the Government than they do when they sell them to other buyers. They feel that unless they are allowed to use good shipping judgment they should not be responsible for potatoes left on the track indefinitely, shipped in too hot weather or otherwise delivered different than commercial practice has indicated being proper.

There is some agitation for a Long Time Potato Program including Marketing Agreements, utilizing and support of low grades and off sizes with ample research to increase consumption. Our growers seem to be in favor of a price support level high enough to prevent disaster in adverse years and low enough to discourage speculative planting. They think that marketing agreements and the other provisions will mean a steady supply of quality potatoes for the consuming public at a fair price.

On the 10th of April some potatoes were being planted in the early sections of up-state New York. Planting in this area will not begin to be extensive however, for another month.—H. J. EVANS.

SOUTH CAROLINA

Excessive rains have hampered all farm operation in Coastal South Carolina since last fall. Potato planting began on schedule about the 1st of February, but was interrupted every few days by rain. Normally our planting operation is completed by the first week of March, but considerable acreage was planted rather late in the month. Some of our acreage was re-planted after the seed decayed, whereas a small acreage was planted to other crops. Estimates on loss in stand vary from 25 to 50 per cent. The plants that have emerged are spotted over the fields on the better drained areas. This makes it necessary to cultivate, dust, etc., the entire acreage in order to care for the 50 to 75 per cent stand. It is doubtful if South Carolina can produce more than one-half a normal crop even if conditions are excellent from now until harvest.

Growers are planning to wash as many potatoes as last year, in

fact, it is hoped that a large portion of the crop will move to market washed and refrigerated.

Seed inspections indicate that Sebago and Katahdin comprise nearly three-fourths of the acreage. The Cobbler, which ten years ago comprised 95 per cent of the acreage is now down to 10 to 15 per cent. Pontiac and Bliss comprise about 5 per cent of the 1947 acreage and White Rose approximately 3 per cent.—W. C. BARNES.

SOUTH DAKOTA

Potato planting will start in South Dakota about the 15th of April, which will be nearly two weeks earlier than last year. The acreage in the certified area will be about the same as last year. There may be a slight decrease in the commercial acreage planted. Shipments of the 1947 crop are about completed at this writing. White potatoes were slow with many cars going to the P. and M. A. at $2.75 per cwt. The Government took 147 cars of the 1947 crop. These went for school lunches, relief, storage and for the manufacture of potato flour.

E. A. Fletcher was elected President of the South Dakota Potato Growers' Association and C. A. Larkin, Vice President, at the annual meeting, March 18. Marx Koehnke of Nebraska flew in for the annual meeting and talked on certification problems.

Applications have been received for the position of head field inspector from a number of well-qualified men and one will be selected soon.

The association will also work with South Dakota State College in securing a plant pathologist to work on disease problems and seed selection.—JOHN NOONAN.

VIRGINIA

Present prospects are for a late but heavy crop of early commercial potatoes. Growers were later than normal in getting the crop planted, but the weather since planting has been very favorable. There have been two cold spells of brief duration, but these have not been accompanied by too much moisture, and no rotting of seed pieces in the ground has been as yet indicated. Most of the planting was completed by the 20th of March. We understand that planting was much later than usual in North Carolina, and suspect that the North Carolina growers will be marketing a large percentage of their crop at the same time that the Virginia growers will market their crop this year. This will probably mean that a larger proportion of the crop in this area will go to the Government. We hear rumors in this area that South Carolina has less than one-half a crop. Since about 70 per cent of their plantings

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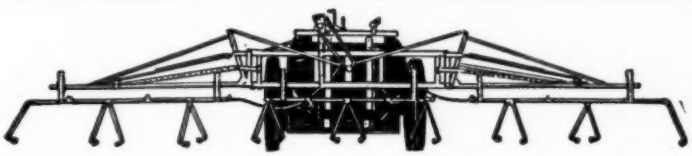

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were Sebago, most of which would have been harvested later than their Cobblers and at approximately the same time as our Cobblers in Virginia, our growers feel that prices here may be a little higher than they otherwise would have been.

The Norfolk and Southern Railroad is building a large packing shed at Euclid, Virginia, near Kempsville, on their railroad tracks to Virginia Beach for use by C. W. Capps, the largest potato shipper in this area. Mr. Capps has ordered five potato washers and driers for this shed. They will be installed and in operation at the beginning of our harvest season. There is a good possibility that two other washers will operate in the Norfolk section. We have heard that at least two washers and driers will be installed on the Eastern Shore of Virginia.

When the Euclid shed is completed, Mr. Capps will cease to operate his packing sheds in the lower part of Princess Anne County. It is rumored that the Norfolk and Southern Railroad will take up its tracks which now run into that section.

Last year about one million 10-pound bags of Virginia early commercial Irish potatoes were packed on the Eastern Shore. This year we look for a much larger quantity of potatoes to be packed in consumer-size packages. Mr. Capps intends to pack a sizeable proportion of his output from the large Euclid packing shed in 10-pound bags. By running his machines day and night, he will have a capacity of nearly 100 carloads per day, or about 20 cars for each washer and drier. The capacity of these washers and driers is one carload per hour. We understand that all of them are ordered from American Potato Driers, Inc., Raleigh, North Carolina. This company has more potato washers and driers in operation than all others combined in the east.—EDWIN W. CAKE.

WASHINGTON

The Director of Agriculture of the State of Washington recently established a bacterial ring rot quarantine. The conditions governing shipments of certified potatoes follow.

Each shipment must be accompanied by a quarantine certificate signed by a duly authorized inspector of the Department of Agriculture at the point of origin stating (1) that the seed potatoes are "certified" by and labeled in accordance with the procedures and in compliance with the rules and regulations of the official certifying agency; (2) that the certified seed potatoes are reported to be free from Bacterial Ring Rot; (3) every person importing certified seed potatoes shall notify the inspector in charge of inspection in any area regarding the place and time of arrival at point of destination where inspection may be made;

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"	4—"	1	"	14—"	4
"	5—"	3-5-7-8-9	"	17—"	3
"	6—"	4-6-10	"	20—"	2
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(4) every person transporting or importing certified seed potatoes shall make such potatoes accessible for inspection and shall so place them as to disclose their quality and condition; (5) any inspector may inspect any imported potatoes in transit or at point of destination; (6) certified seed potatoes found to be in the opinion of the inspector, infected with bacterial ring rot, shall be placed under "Quarantine"; (7) no person shall sell or offer for sale, move, allow or cause to be moved any such certified seed potatoes or remove such quarantine certificate without the written authority of an inspector; (8) the inspector shall notify the person concerned after placing the quarantine on the certified seed potatoes; (9) in doubtful cases samples of said certified seed potatoes shall be taken for a microscopic examination; (10) when on examination the certified seed potatoes are found to be infected with bacterial ring rot the inspector shall notify the "person" concerned. The "person" concerned shall cause such potatoes to be disposed of as the inspector may direct; (11) the inspector may give directions to the "person" concerned, or ultimate consignee as to the treatment of the container and equipment used in the handling and transporting of the certified seed potatoes; (12) if on examination the certified seed potatoes shall be found free from bacterial ring rot the inspector shall release said shipment concerned; (13) any person who shall violate or fail to comply with any rule or regulation adopted and promulgated by the Director of Agriculture in accordance with and under the provisions of this act shall be guilty of a misdemeanor, and for a second and each subsequent violation or failure to comply with the same rules or regulations, shall be punished by imprisonment in the county jail for not less than thirty days or more than one year, or by fine of not less than $100.00, or more than $1,000.00 or both such fine and imprisonment.

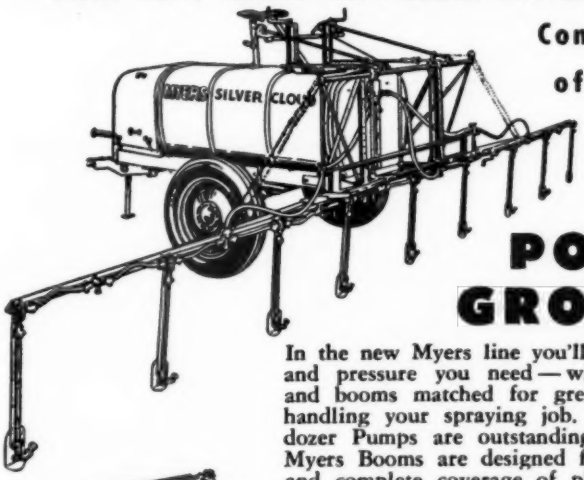
All employees of the Horticultural Division of the Department of Agriculture are hereby empowered and instructed to carry out the provisions of this order.

This order shall take effect on and after the 18th of March, 1948. —Fred J. Martin, Director of Agriculture.

PROVINCE OF ONTARIO

Fourteen resolutions were discussed and approved at a recent meetings of the Potato Section, Ontario Crop Improvement Association, held in Toronto. The organization is looked upon as a central clearing house for problems affecting potato production and marketing within the Province. There are active branches in every county and district in the Province, and official delegates representing each of 53 local associa-

See the New MYERS SPRAYERS



Complete range of models for

POTATO GROWERS

In the new Myers line you'll find the capacity and pressure you need — with pumps, tanks and booms matched for greatest efficiency in handling your spraying job. Myers new Bull-dozer Pumps are outstanding in performance. Myers Booms are designed for easy operation and complete coverage of plants. Inspect this complete line of Power Sprayers for every need. Write for new catalog.

THE F. E. MYERS & BRO. CO.
Dept. K-281, Ashland, Ohio

For

Reliability—Service—Quality

Better Potato Buyers

Prefer

Aroostook Potato Growers, Inc.

PRESQUE ISLE, MAINE

Harry E. Umphrey, *President*

tions attended the Provincial meeting, together with large numbers of growers and Departmental officials.

The subjects dealt with in resolution form were: Scab Control Research; Co-operative Plan for Central Storage; Pre-packaging and Marketing; Bacterial Ring Rot; Spray and Dust Program; Potato Certification Reports to Growers; Disinfection of Used Potato Bags; Variety Testing; Freight Assistance on Seed; Percentage of D.D.T. in Dusts; Standardization with Simplification of Commercial Products in Naming Spray and Dust Preparations; Strict Enforcement of Grade Regulations, and Appreciation.

The Resolutions Committee was headed by Stewart L. Page Barrie as *Chairman*. Other members were: A. V. Mason, Dundas; G. A. Hackett, Cochrane; Douglas L. Parks, Kemptville, and Clifford Wallwork, Stouffville.—R. E. GOODIN.

THE NATIONAL ONION AND POTATO COMMITTEE

On the 24th of February, 1948, we asked the subcommittee on appropriations for agriculture to raise federal appropriations for breeding better potato varieties for our country from $50,600 per year to $100,600; and for breeding better onions from $15,380 per year to $25,380 per year.

It is well for the technical servants of any industry to understand that their support does not just grow on bushes. Some one must back their work constantly. The men making this particular part of the effort are: Above. From left to right.—Veril Baldwin, of Jackson, Michigan; David R. C. Smith, of Canastota, New York; Sam Kennedy, *Chairman*, Clear Lake, Iowa; Paul A. Xander, *Chemist*, the Wise Company; Representative John W. Gwynne, of Iowa, in charge

If Cuprinol has been proven to be a successful treatment to stop mildew formation in the Apple Storage Rooms of Pennsylvania State College. (They were completely treated with Cuprinol in the Summer of 1943, and since then no mildew removal has been necessary, no painting or whitewashing, no further Cuprinol treatment.)

Then Isn't Cuprinol treatment of your potato storage rooms and bins an important thing to consider—and to use?

CUPRINOL®

WOOD PRESERVATIVE

Cuprinol is a liquid, easily applied by brush, spray or dip, that penetrates the fibres and protects wood construction against mildew, rot and insect borers. Use it by itself or under paint on cold frames, flats, benches, stakes —wherever moisture and contact with soil leads to rapid rot and decay. Allow a gallon, brush applied, for approximately 400 sq. ft. Gallon can $3.45; 5 gallon pail, $3.35 per gallon; 50 gallon drum, $3.10 per gallon. Through local lumber, hardware and farm supply dealers. Or write for full information.

CUPRINOL Division, Darworth, Inc.

9 Wood Street **Simsbury, Conn.**

of the case in Congress; Earl V. Wise, Berwick, Pennsylvania, largest manufacturer of potato chips, who finds he cannot use Katahdins; A. R. Barham, Manager of export sales, the Bean Manufacturing Company; Godfrey L. White, Osceola, Arkansas; Leslie T. Wells, Riverhead, Long Island, New York; C. L. Fitch, secretary of the National Potato and Onion Committee; and Ed A. Trexler, Lenhartsville, Pennsylvania. These and other commercial people paid their own traveling expenses, and had contributed, since December, from their own pockets, mostly at the rate of $100.00 each, $1550.00 towards other costs for several years ahead.

The committee feels that no large valuable results, except great increase in knowledge, have been achieved in potato breeding, because the varieties already produced, although selling in great quantities because of their beauty, are of such poor table quality that they have reduced potato consumption and therefore threaten the future of the industry. The committee recognizes that such projects must be in the hands of research men and in close touch with educational institutions, because all existing knowledge must be the basis, and much new knowledge must be produced. The committee states, however, with considerable patience, that these projects, are not primarily research, but commercial effort for results of use to taxpayers. Increase of knowledge is not the end sought; it is only the necessary means to the business end. They again stated that the foremost objective should be a potato of high table quality, like the Cobbler, which is smooth and does not scab—all other objectives being minor to this one.

The arguments used at this hearing were: (1) that commercial success in potato breeding should be hastened; (2) that one member of the party alone was paying more federal income tax per year than the asking and that the industries were entitled to service; and (3) that although there were as yet no material benefits from the $2,000,000.00 and more, spent in 20 years on potato breeding, by the nation and the states,— yet one onion variety produced by these funds: the Excel, now maturing in south Texas, was returning a net increased profit over all the costs to date on both projects, so that the whole job is out of the red, with the vast profits still to be achieved.—C. L. Fitch.

CASH IN ON SCIENCE... *use these tried and proven products by*

ORIGINATORS OF Geigy DDT INSECTICIDES

GEIGY'S E 25

—an emulsifiable solution containing 25% Geigy DDT (by weight) for use in the preparation of sprays for crop protection.

GESAROL AK 50

—a finely-ground, wettable powder containing 50% Geigy DDT especially adapted for use in making sprays to control *potato* and *orchard* pests.

GESAROL VD 50

—a finely-ground powder containing 50% Geigy DDT—used by your local mixer in making 3-5% DDT dusts for general agricultural use. When buying dusts from your dealer, look for the GESAROL VD 50 seal on the bag.

GY-COP "53"

—a chemically stable, insoluble basic copper sulphate with a guaranteed metallic copper content of 53%. Used in sprays or dusts to control early and late blight.

POTATO VINE AND WEED KILLER

—applied at the rate of 1 gal. in 100 gals. of water to quickly kill potato vines so tubers may mature and digging is easier.

GEIGY LEADS THE FIELD WITH 9 YEARS OF EXPERIENCE IN COMPOUNDING EFFECTIVE DDT INSECTICIDES.

GEIGY COMPANY, INC:

89 Barclay Street, New York 8, N. Y.

ANNUAL MEETING

The annual meeting of the Potato Association of America, held at Chicago December 29-31, 1947, was one of the best attended in years. Abstracts of most of the papers presented were printed in the February issue of the Journal. The complete papers will appear in future issues.

Statement for the Year Ending December 15, 1947

Treasurer's Report

RECEIPTS:

Balance from November 30, 1946	$1985.51
Annual Dues	3289.73
Sale of Advertising	4044.21
Sale of Reprints	427.61
Miscellaneous	99.47

Total Receipts $9846.53

DISBURSEMENTS:

Printing of Journal (13 issues)	$4178.95
Printing of Reprints	465.75
Mailing and Supplies	679.60
Miscellaneous	778.62
Secretarial Work	450.00
Stenographic Work	575.00

Total Disbursements $7127.92

Balance on hand Dec. 15, 1947, $2718.61.

Accounts Receivable: Advertising, Part of September and October. All of November.

Accounts Payable: Printing of November issue American Potato Journal.

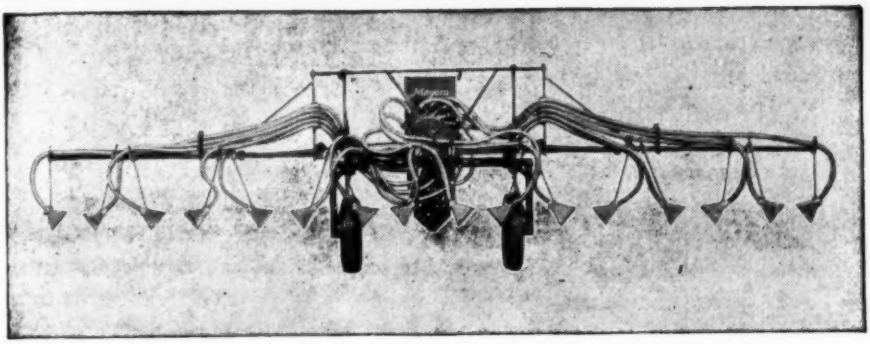
Report of the Auditing Committee

We, the undersigned Auditing Committee, have examined the books of the Potato Association of America and have found them to be correct.

E. L. Newdick, *Chairman*,
Melvin Rominsky,
John C. Campbell.

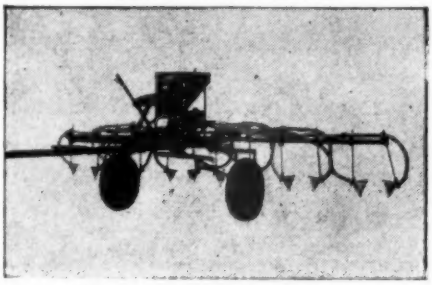
A DUSTER for every CROP—
A DUSTER for every GROWER!

COMPLETE and EFFECTIVE application for the grower with 5 or 500 acres.



Niagara Model AA Power Take-off Tractor Trailer Duster

OTHER FAMOUS NIAGARA-MADE CROP DUSTERS
DRI-FOG DUSTER (6 to 18 nozzles)
CYCLONE CROP DUSTER (20 and 24 nozzles)



Niagara 12-Nozzle, 6 Row Cropmaster Duster.

Niagara—pioneer manufacturers of dusts and dusters—offers growers complete protection which means greater yields, better quality and higher profits. There is a Niagara machine designed for your wants. There is a Niagara formulation of dust or spray, for every common vegetable pest, insect or fungus disease, to meet your specific needs. Ask your dealer or write for information.

WHEN YOU BUY Niagara YOU BUY PROTECTION

NIAGARA CHEMICAL DIVISION

FOOD MACHINERY CORPORATION

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New Orleans, Louisiana ● Greenville, Mississippi ● Harlingen, Texas
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The following resolution was adopted at the business session:

Potato Introduction Station Recommended by Potato Association of America

The following resolution of the Potato Breeding Committee of the Potato Association of America was approved by the Association December 29, 1947, at Chicago:

"The Potato Association of America recommends: That a station be established for the maintenance and preliminary evaluation of wild and cultivated tuber bearing species of Solanum and closely related forms.

That the station be set up to serve the four regions and the United States Department of Agriculture as provided for in the Research and Marketing Act.

That provision be made to study the botanical and genetic relationships, as well as the morphological and physiological characteristics and economic potentialities of the material.

It is recommended that representatives of the Technical Committees of the four Cooperative regions and of the Bureau of Plant Industry meet to formulate a program and make recommendations for implementing the objectives stated above.

It is recommended that the Secretary of the Potato Association of America inform the four regional administrative advisers and the Chief of the Bureau of Plant Industry, Soils and Agricultural Engineering, of this action and that this resolution be printed in the American Potato Journal."

Potato Breeding Committee for 1947 of the Potato Association of America.

G. H. Rieman, *Chairman,*
Julian C. Miller,
C. O. Erlanson,
F. A. Krantz,
Donald Reddich,
F. J. Stevenson, *Secretary.*

Dr. William Stuart and Dr. C. F. Clark were elected honorary members of the Association in recognition of their long years of outstanding service to the potato industry. Dr. E. V. Hardenburg, in presenting the award to Dr. Stuart, read the following citation.

Dr. William Stuart

Dr. William Stuart, now residing in Tokoma Park, Washington, D. C., was recently retired as Principal Horticulturist of the United

To Protect Your Potato Crop

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Super Fused

INSECTICIDE • FUNGICIDE

MACK O BLEND *for Dusting*

MACK O SPRAY *for Spraying*

Save time and money with McConnon's *combination* Insecticide and Fungicide. Dusting with MACK O BLEND or spraying with MACK O SPRAY will give effective control over BOTH potato insects and blight.

MACK O BLEND and MACK O SPRAY are Super Fused through an *exclusive* McConnon process which completely combines diluents with toxics for greater killing power—more uniform coverage, economical insect and blight control.

Rely on McConnon for the *latest* and *most effective* insecticides and fungicides for every purpose. All are laboratory and field tested—and proved for performance by America's largest growers.

for
QUALITY
DEPENDABILITY
ECONOMY

McConnon & Company

WINONA, MINNESOTA

States Department of Agriculture. For many years this organization which he helped to found enjoyed the benefits of his scientific training, his wise counsel and his effective leadership both at and between its annual meetings. We who have known him these many years especially miss him on occasions such as this. Few people have enjoyed as wide an acquaintance among both scientists and practical farmers throughout the world as has Doctor Stuart.

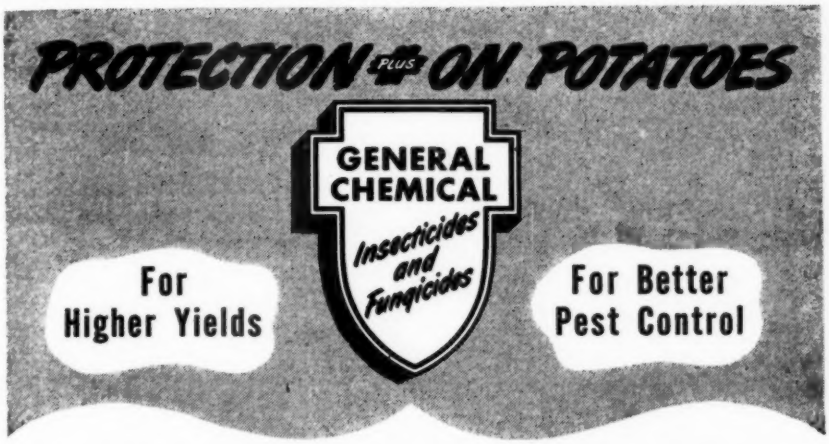
Born at St. Remi, Quebec, Canada, and receiving his elementary school education there, he early in life came to the United States to pursue his professional career. He received his B.S. degree at the University of Vermont in 1894, after which he served as assistant botanist from 1894 to 1901 and as associate horticulturist from 1901 to 1902 at Purdue University. From 1902 to 1909 he was Professor of Horticulture at the University of Vermont. Here he published several bulletins and scientific articles of primary interest to the science of potato production. Later his alma mater awarded him the honorory degree of Doctor of Science in appreciation of his contributions to science in this field. He added to his fund of knowledge by studying in Germany and in after years was invited to speak before the Royal Horticultural Society of London. Doctor Stuart's longest and most noteworthy period of service was as horticulturist and potato specialist in the United States Department of Agriculture from 1912 to 1935.

Doctor Stuart is probably most famous for his book entitled, "The Potato," which has been used as a text at many institutions in America and for his Classification of American Varieties of Potatoes. In collaboration with Dr. C. F. Clark of the U. S. Department of Agriculture he was indeed a pioneer in the field of potato breeding and the improvement of varieties.

We who are assembled at another Annual Meeting of the Potato Association of America take genuine pride in honoring Doctor Stuart and in conveying to him on this occasion our heartfelt esteem and our wishes for many more years of happy and productive life.

Dr. Donald Reddick then gave the following citation for Dr. Charles Clark.

Our Association does honor to itself in presenting this slight token of appreciation to a member who has done so much to further our common interest Doctor Charles F. Clark has given virtually all of his mature effort to a program of improvement of the queen of the vegetables and to this day continues his work though he has been officially retired and is privileged to enjoy the freedom of the contemplative life.



25% DDT Emulsifiable Oil Concentrate

GENITOL* EM-25

Made for easy, convenient mixing with water, especially for spraying potatoes. Genitol EM-25 has proved effective at economical dosage in control of Colorado potato beetles, aphis, flea beetles and leaf hoppers. It may be used in combination with neutral copper fungicides, such as General Chemical Spraycop,* for combined control of insects and blights.

50% DDT Spray Powder

GENITOX* S50

Particles of Micron Fineness

A 50% DDT wettable powder, especially milled for finest particle size. Poured directly into agitated spray mixture, Genitox S50 mixes completely in hard or soft water, obtaining quick wetting and dispersion without excessive foaming. Because it is especially processed to stay in fine flocculated suspension, Genitox S50 provides highest possible deposits of the DDT material, in a uniform spray cover on foliage, with only minimum run-off of the insecticide. Unexcelled for control of potato insects mentioned above. May be used with neutral copper fungicides.

*Reg. U. S. Pat. Off.

DDT-Basic Copper Concentrated Spray Powder

GENICOP* SPRAY POWDER

Micron-Fine Particles

A combination of 25% pure DDT and 73% Basic Copper Sulfate with special conditioning and depositing agents, providing excellent coverage and all-around spray efficiency. This concentrated insecticide - fungicide offers economy and time-saving convenience for combined control of early and late blights, Colorado potato beetles, aphis, flea beetles, and leaf hoppers—in one material.

Neutral Copper Fungicide Spray Powder

SPRAYCOP*

A specially processed neutral copper fungicide of unusual chemical stability, high in copper content, for control of early and late blights. Outstanding for fungicidal effectiveness.

FOR DUSTING: Ask about General Chemical's Copper Dusts and DDT Dusts to suit every insect and blight problem on potatoes.

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ORCHARD BRAND SPRAYS & DUSTS

Doctor Clark is a Vermont Yankee in the very finest sense of that connotation. He earned his baccalaureate at the University of Vermont, and his doctorate at Cornell University. His association with Dr. H. J. Webber, who came to Cornell in 1908, undoubtedly started him on his life work. After a few years in the "west" where he inaugurated the work of the Greeley Station in Colorado, he migrated back east. For a time he spent his summers in Presque Isle, Maine, but later spent his winters in Washington.

In a big undertaking for the improvement of an important crop some one must do a great deal of spade work. Clark has done it for the potato and in consequence, the work of all of us has been made easier. I am sure all of us wish for him many more years of useful work.—DONALD REDDICK.

The following officers were elected for 1948:

President .....E. L. NEWDICK
Vice-President .....O. D. BURKE
Directors .....HAROLD MATTSON
W. A. RIEDL
W. D. KIMBROUGH

The following officers were appointed by the President:

Secretary .....H. A. REILEY
Treasurer .....JOHN C. CAMPBELL
Editor .....W. H. MARTIN

MERCK PRODUCTS FOR THE GROWER

Corrosive Sublimate
Yellow Oxide Mercury
Hormodin (Available in powder or liquid form)
Hormodin is the root-forming chemical developed by The Boyce Thompson Institute for Plant Research, Inc.
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SPRAYING or DUSTING
USE
"OHIO SUPERSPRAY" HYDRATED LIME

with a guaranteed fineness of 99½% passing a screen having 105625 openings per square inch. It contains magnesium and calcium. Insures greater coverage and yields.

OHIO HYDRATE & SUPPLY COMPANY
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Manufacturers of Various Forms of Lime and Limestone Products

Boggs

The "Standard"
Potato and Onion Grader

Not only "STANDARD" but "Superior" in Economy, Accuracy, Speed, and Adaptability.

More Boggs Graders in use than all other makes combined—there must be a reason. Send for our new circular and price list.

BOGGS MFG. CORP., Atlanta, N.Y.

Yes, I make discs in all sizes of holes and all diameters, for all makes of nozzles, also whirls, strainers and rubber or leather washers.

DISCS 5c ea. Washers, either kind, 2c ea.
Whirls for Bean or Farquhar Iron Age
Two Hole Hardened Steel .....45c ea.

Two Hole Brass .....55c ea.

Post paid on receipt of M.O. or check
Catalogue, prices and samples on request
LLOYD E. JENNINGS, Somers 3, Conn., U. S.A.

THE CONSTITUTION AND BY-LAWS POTATO ASSOCIATION OF AMERICA

As Drafted by the Exceutive Committee at New Brunswick, N. J.

June 2, 3, 4, 1947

RATIFIED DECEMBER 29, 1947

ARTICLE I — *Name*

The name of this organization shall be The Potato Association of America.

ARTICLE II — *Objective*

The objectives of this Association shall be to collect and disseminate scientific and general information relating to all phases of the potato industry, including research in the production, transportation, processing, marketing, and utilization of seed and table potatoes.

ARTICLE III — *Membership*

Section 1. Any person may become a member of this Association upon a payment of the Membership Dues fixed by the By-Laws. Such memberships may be annual, life, patron, or honorary.

Section 2. Voting privileges shall be limited to members in good standing.

ARTICLE IV — *Officers*

Section 1. The officers of this Association shall be President, Vice-President, Secretary and Treasurer.

Section 2. The duties of the officers shall be those customarily pertaining to these offices.

Section 3. Each officer shall hold office until the expiration of the term for which he is elected or appointed, and until his successor is duly elected or appointed and qualified.

ARTICLE V — *Executive Committee*

Section 1. The governing body of the Association shall be an Executive Committee, which shall consist of the contemporary officers, the retiring President, the Editor-in-Chief, and three Directors elected at the Annual Meeting.

Section 2. The President shall call meetings of the Executive Committee at his discretion, or upon written request of three of its members.

Section 3. The presence of a majority of the Executive Committee shall constitute a quorum for the transaction of business.

Section 4. All actions of the Executive Committee or Officers, must be authorized or approved by the Association at the Annual Meeting, except as specified in Article VIII, Sec. 3.

ARTICLE VI — *Election of Officers and Executive Committee*

Section 1. The President and Vice-president shall be elected for one-year term at the Annual Meeting. Three Directors shall be elected at the Annual Meeting in 1947: one to serve for one year, another for two years, and the third three years. Thereafter the Directors shall serve for a term of three years. Nominations for the officers and Directors shall be made by a Nominating Committee appointed by the President and additional nominations shall be accepted from the floor at the Annual Meeting, or as otherwise directed by the Executive Committee. Voting for the officers shall be by ballot, and a plurality shall elect.

Section 2. The Secretary and the Treasurer shall be appointed by the Executive Committee ordinarily for terms of two years, which shall not expire concurrently, and the Executive Committee may adjust the term or the date of assuming office to avoid this contingency.

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ORDER ARMOUR'S NOW

Fertilizer materials are still in short supply. To be sure you have your goods when you need them, place your order now for Armour's Big Crop Fertilizers.

Armour's are proven potato producers, formulated from only the highest quality plant food materials—properly aged, cured and blended. We recommend them to all growers who want larger yields of quality, true to type potatoes that bring higher profits.

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Armour Fertilizer Works

New York, N. Y.
Presque Isle, Me.
Cincinnati, Ohio
Sandusky, Ohio
Baltimore, Md.
Chicago Heights, Ill.

Section 3. The President and the Vice-president shall assume office upon the final adjournment of the Annual Meeting at which they are elected.

Section 4. The Executive Committee may fill by appointment, any vacancy occurring within the prescribed term, such appointment to continue for the unexpired balance.

ARTICLE VII — *Meetings*

A general meeting of the Association shall be held annually, unless prevented by a National Emergency, at such time and place as the Executive Committee shall direct, unless otherwise ordered by the Association. Special or local meetings may be arranged at the discretion of the Executive Committee.

ARTICLE VIII—*Committees and Conduct of Association Business*

Section 1. The Executive Committee or the President shall appoint such standing and special committees as may be appropriate to conduct the business of the organization.

Section 2. Standing Committees are those whose functions include the general policies and internal relations of the organization, and its relations with other organizations. These Committees shall have a revolving membership, and shall submit an annual report to the Executive Committee at the Annual Meeting of the Association.

Section 3. The Executive Committee may undertake and carry out such special activities between Annual Meetings, including reference of questions to membership, by mail or special notices in the Journal.

ARTICLE IX—*Journal and Editorial Board*

Section 1. The Official publication of the Association shall be the AMERICAN POTATO JOURNAL.

Section 2. The Executive Committee may appoint an Editor-in-Chief and an Editorial Board as prescribed in the By-Laws. A business Manager may also be appointed, who may be the Secretary or the Treasurer, at the discretion of the Executive Committee.

Section 3. The Executive Committee may authorize the Editor-in-Chief, or other officers, to employ such assistants as may be necessary for the proper conduct of their work.

ARTICLE X—*Funds*

The control of Funds of the Association received from all sources shall be vested in the Executive Committee, to administer through the appropriate fiscal officers and committees. An audit of the receipts and disbursements shall be made annually by an auditing committee, or at the discretion of the Executive Committee by a certified public accountant. The reports of the Treasurer or other fiscal officers, together with that of the Auditing Committee, shall be published annually, in the official publication.

ARTICLE XI—*Method of Ratification and Amendment*

Section 1. This Constitution shall become effective upon its ratification by the 1947 Annual Meeting, and shall supercede the original Constitution and all amendments thereto.

Section 2. This Constitution may be amended at any Annual Meeting of the ASSOCIATION, or at any regular meeting called for this purpose, provided that any proposed Amendments be approved by the Executive Committee, and that it receive the affirmative vote of at least two-thirds of the members voting at a regularly scheduled business session.

What Wholesalers and Retailers say about Pre-packaged Produce...

In a prepackaging survey just completed by FOOD TOPICS both wholesalers and retailers of produce report sales increases ranging from 10% to 150% in this type of merchandise. They say (1) prepackaging facilitates self service (2) identifies produce by brand (3) reduces freight cost (4) cuts waste and spoilage (5) materially increases sales. It's the way to sell potatoes too when they are packaged the exact weight way. If you sack in consumer bags use EXACT WEIGHT Scale Model 708-P (illustrated) built specially for potato growers and distributors. Whatever weight bag you package there is an EXACT WEIGHT Scale for the job. Write for details for the size bag you package.

EXACT WEIGHT Scale Model 708-P—Features: Special commodity holder, tilted and equipped with guard to hold bags . . . dial 6" wide, 1 lb. overweight and underweight by 4 oz. graduations and in direct line of operator's vision . . . nonbreakable dial glass . . . short platter fall for speed of operation . . . Capacity to 15 pounds.

"Sales and Service from Coast to Coast"

INDUSTRIAL PRECISION

Exact Weight Scales

THE EXACT WEIGHT SCALE COMPANY

713 W. Fifth Ave., COLUMBUS 12, OHIO

BY-LAWS

1. Membership and Dues

A. *Members*

The individual annual membership fee shall be Two Dollars ($2.00), including a subscription to the American Potato Journal.

The Executive Committee may authorize group memberships at a reduced rate ,as set from time to time by such committee.

B. *Life Members*

Life memberships may be granted to any person upon payment of Thirty-five Dollars ($35.00).

C. *Patron Members*

Patron memberships may be granted to any person (or firm) upon payment of One Hundred Dollars ($100.00).

D. *Honorary Life Members*

Honorary life membership may be granted at the discretion of the Executive Committee to individuals who have contributed to the interests of the potato industry in an outstanding manner. Not more than two (2) new honorary members shall be elected each year.

2. American Potato Journal

A. *Editorial Board*: The policies governing publication of the Journal shall be vested in an Editorial Board, consisting of an Editor-in-Chief, and such associate editors as may be selected at his discretion. The Editorial Board shall have authority to reject any paper deemed unworthy of publication in the Journal.

B. The Editor-in-Chief may receive compensation for his services as determined by the Executive Committee.

C. *Subscriptions* and *Back Numbers*: Subscriptions to the American Potato Journal for institutions and non-members shall be $2.00 per year. The sale and price of back volumes or numbers shall be determined by the Editor-in-Chief with the approval of the Executive Committee. Requests to supply lost copies without charge must be made within sixty days from date of issue.

3. Duties of Officers

A. The President shall preside at business meetings and general sessions of the Association, and serve as chairman of the Executive Committee.

B. The Vice-president shall assume the duties of the President in his absence or incapacity and shall serve as a member of the Executive Committee.

C. The Secretary shall keep the records of the Association at all of the regular or special meetings, and a record of meetings of the Executive Committee, shall make the necessary arrangements for the annual or other meetings at the direction of the Executive Committee, and shall serve as a member of the Executive Committee.

D. The treasurer shall keep, or cause to be kept, full and accurate accounts of receipts and disbursements in books belonging to the Association and shall deposit all moneys and other valuable effects in the name of and to the credit of the Association in such depositories as may from time to time be designated by the Executive Committee. He shall disburse the funds of the Association as may be ordered by the Executive Committee, taking proper vouchers for such disbursements, and shall render to the President and Executive Committee whenever they may require it, as well as to the Annual Meeting of the Association, an account of all his transactions as Treasurer and of the financial condition of the Association.

MODEL PB-3 WEED BURNER

The Model PB-3 is here shown in use in potato fields. Used to destroy green immature vines it permits harvesting operations without waiting for normal maturing of vines or their elimination by killing frost.

Vegetation which has accumulated after cultivating is no longer possible, is completely eradicated and permits efficient digger operation. Clean fields result in fewer potatoes being lost as they can easily be seen by pickers.

The use of the Model PB-3 is not restricted to the burning of potato vines as it can be used wherever weed eradication is necessary.

At a speed of 5 m.p.h. the Model PB-3 consumes 18 gallons of fuel oil per acre and burns 4 rows or a swath 15 feet wide on each trip.

References by potato growers using the Model PB-3 furnished on request. They will give you their actual experience with the use of this machine.

WOOLERY MACHINE COMPANY

Pioneer Manufacturers of Open Flame Type Weed Burners

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4. Duties of the Executive Committee

The Executive Committee shall act for the Association in the *interim* between Annual Meetings; shall fix the date of the Annual Meeting; and shall consider matters of general policy in the Association and present their recommendation at the Annual Meeting. The Executive Committee shall meet prior to the Annual Meeting of the Association, or at other times approved in Article V, Section 2, of the Constitution.

5. Quorum

Ten members of the Association shall constitute a quorum for the transaction of business at a regularly called annual or special meeting, of which at least thirty days' notice shall have been given to members.

6. Committees

A. *The Program Committee*: This Committee shall consist of the Secretary who shall act as chairman, together with the other officers of the Association. This Committee shall have full authority over the scheduling of sessions and demonstrations, and the allocation of papers. It shall receive titles and arrange the program of the Annual Meeting, arrange symposia, accept or reject titles and may invite non-members to participate.

B. *Nominating Committee*: This Committee shall consist of three members at large appointed by the President. Their duties shall consist of presenting a list of nominees for the various offices at the following annual or regular meeting of the Association. In selecting nominees an effort shall be made to provide representation from the major fields of membership of the Association.

C. *Membership Committee*: This Committee shall be appointed by the President and its duties shall be the promotion of membership in the Association. The Secretary and Treasurer shall serve on this Committee.

D. *Auditing Committee*: This ommittee shall be appointed by the President to audit the books of the Association, and report at the Annual Meeting.

E. *Committee for Local Arrangements*: This Committee shall be appointed by the President and be combined with the Program Committee, and shall work closely with the Program Committee in making local arrangements for the Annual Meeting.

F. Other committees may be appointed by the President, as deemed advisable, to study and report on other special fields of activity associated with the potato industry.

7. Miscellaneous

A. The fiscal year of the Association shall be from December 1 to the following November 30.

B. *Liability*. The liability of each officer and member shall be limited to the amount of his dues for the current year.

8. Amendments

These By-Laws may be amended by a majority vote at any regular meeting or by a majority vote of the members voting in a ballot by mail.

POTASH FOR AMERICAN FARMS

The American Potash Industry, to keep American farms operating in high gear, is now producing and delivering for agriculture more than three times as much potash as it did in 1939. This increase has risen steadily from 263,842 tons K_2O in 1939 to nearly 900,000 tons in 1947, despite great man-power, equipment, and shipping difficulties. While present supplies may not enable everyone to get all the potash he wants to use, every effort is being made to meet the greatly increased demand for this essential plant food.

Consult your official agricultural adviser or experiment station about the amount of plant food needed to grow your crops and how much your soil will supply. If you have not had your soils tested, make plans to have this done. The information to be gained from these tests will be a helpful guide in your use of fertilizers.

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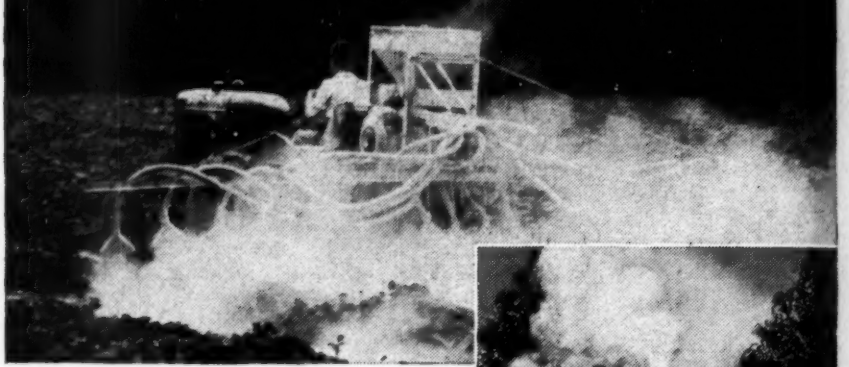

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ONE grower reports 65 acres dusted in a single afternoon . . . another says, "We dust as high as 50 acres in 5 hours with our Iron Age Duster" . . . still another claims, "Wouldn't think of using any duster but Iron Age for my 550 acres of cotton — it's quick, sure-fire protection." The same goes for all growers—whether the crop is potatoes, beans, cotton, peanuts, tomatoes, fruit—they're sold on the dependable, low-cost protection of rugged Iron Age High Velocity Dusters. Precision-built, high-speed blower runs easily, delivers strong, accurate air blast that boils dust around, above, below and between every stalk, leaf or vine. Levers permitting boom control from tractor seat eliminate nozzle drag . . . nozzles are adjustable to any position. All types—traction, power take-off and engine powered; horse or tractor drawn and tractor-mounted models for row crop, orchard, grove or vineyard use.

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